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THE NATIONAL GEOLOGICAL SURVEYS OF EUROPE.

BY

WILLIAM TOPLEY,

F.G.S., ASSOC. INST. C.E.,

GEOLOGICAL SURVEY OF ENGLAND AND WALES.

PRESIDENT OF THE GEOLOGISTS' ASSOCIATION.

(Reprinted, with an Appendix, from the
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THE

NATIONAL GEOLOGICAL SURVEYS OF EUROPE.

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INTRODUCTION.

IN the following pages a brief account is given of the organisation and publications of the chief Geological Surveys[1] in Europe. The statements are taken from official sources, or from an inspection of the publications.

Information has been kindly supplied by the directors of the following surveys—Austro-Hungary, Bavaria, Belgium, Italy, Norway, Portugal, Saxony, Spain, Sweden, Switzerland; most of these have since corrected the proofs of the parts of this report referring to their respective surveys.[2]

In the preparation of this report my colleague Mr. W. H. Dalton has given me much assistance; my thanks are also due to Professor G. A. Lebour, Mr. W. Rupert Jones, and Mr. F. W. Rudler.

The libraries of the Geological Survey (Museum of Practical Geology), and of the Geological and Geographical Societies, contain a large collection of the maps and other publications of the various surveys (see the 'Catalogues' of those libraries). The more important publications are noted as they appear in the 'Quarterly Journal of the Geological Society' (November number of each year), the 'Proceedings of the Royal Geographical Society,' and in 'Petermann's Mittheilungen' (Gotha). The 'Geological Record' gives descriptions of maps published in and since 1874.

The official title of the Survey is first given, with the place of the head office, which is also the place of publication unless otherwise stated.

[1] The exact equivalent of the English term '*Survey*' is not used on the Continent; it is that of *Committee*, *Commission*, *Inquiry*, *Institute*, or *Service*.

[2] Some corrections and additions, including those thus supplied, have been made since the Report was read at Montreal.

The mode of issue varies greatly, and therefore the exact titles of the publications are given, as far as possible.

For information upon Topographical Surveys reference may be made to the 'Notes on the Government Surveys of the Principal Countries of the World,' prepared at the Intelligence Branch of the War Office, London, and published in 1883 (price 6*s*.). This gives the scales of all the chief maps; plates, with descriptions, of the various signs employed; full tables of all measures of length and surface, with their English equivalents. Brief mention is sometimes made of the Geological Surveys.

In the following pages the natural scale of maps is given, this being the method almost universally adopted on the Continent. The following table gives the equivalents, in English inches, of the scales referred to:—

Natural Scale.	Inches to one Mile.	Countries.
1 : 10,000	6·336	Upper Silesia, Italy (part).
1 : 10,560	6 000	United Kingdom (part).
1 : 20,000	3·168	Belgium.
1 : 25,000	2·534	Prussia, Saxony, Alsace-Lorraine, Italy (part)
1 : 50,000	1·267	Sweden (part), Italy (part).
1 : 63,360	1·000	United Kingdom.
1 : 75,000	·845	Austria and Hungary.
1 : 80,000	·792	France.
1 : 100,000	·633	Italy, Norway, Switzerland, Bavaria.
1 : 144,000	·440	Austria and Hungary.
1 : 200,000	·317	Netherlands, Finland, Sweden (part).
1 : 400,000	·159	Spain.
1 : 420,000	·150	Russia.

The meridian adopted for the maps varies much.[1] As a rule it is that of the capital of the country. The exceptions to this are the maps of Germany and some of Norway, where the meridian is Ferro; Belgium and Switzerland, where it is Paris. Paris has been taken as the meridian for the map of Europe, now being prepared by a committee of the International Geological Congress; scale 1 : 1,500,000. This map, in 49 sheets, will be based upon those of the Geological Surveys hereafter described.

The International Geodetic Congress at Rome in 1883 recommended the adoption of Greenwich as the universal meridian. The Congress met at Washington in October 1884, when the provisional resolution passed at Rome was confirmed.

On the Continent a large number of official and semi-official publications have been made by Government mining engineers and others; but these are not here included unless they form part of a systematic survey or give the main results of such survey.

The earliest detailed survey is that of the United Kingdom, 1832. In all its essential characters this is now much the same as when left by its founder, Sir H. de la Beche, and probably no other survey yet rivals it in the variety and completeness of its publications. Many of the more important Continental surveys have been commenced during the last 15 years.

Much difficulty has been felt in deciding what small general maps should be mentioned. The Catalogues already referred to give the titles of many of them. For the most part those only are here mentioned

[1] The relations of the Meridians to that of Greenwich which are given in this Report, are taken from the *Notes on Government Surveys* referred to above.

which are official, or which are reductions of official maps; and of these the notices are necessarily incomplete.

Some interesting results come out from this investigation as regards the relative amount of work done by private and official geologists. In England the foundations of the survey, and in fact of all detailed field geology, were laid by private workers, and a very large proportion of English geological literature has always come from them. On the Continent this has rarely been so; nearly all the surveys are directly due to the Governments, and much of the geological literature comes from those connected with the surveys, or from official mining engineers. There, also, many professors of geology are connected with the surveys; this is not now the case in England, although many of its professors have at one time served on the staff.

The publications of the English Survey are confined to questions relating to its work and progress; but this is not always the case abroad. The staffs of the Austrian and Prussian Surveys have always been active in working at the geology of districts outside their own special areas, which are by no means small. The best work of late years relating to the geology of Turkey and Greece has been done by officers of the Austrian Survey.

Alsace-Lorraine.

Commission für die Geologische Landes-Untersuchung von Elsass-Lothringen (Strasburg).

The director is E. Cohen. The map—'Geologische Specialkarte von Elsass-Lothringen,' is on the scale of 1 : 25,000.

The publications are 'Abhandlungen,' with atlas, dating from 1875; the first volume contains a Bibliography of the geology of Alsace-Lorraine, by E. W. Benecke and H. Rosenbusch, pp. 77.

A map of the environs of Strasburg—'Geologische Karte der Umgegend von Strassburg,' by E. Schumacher, 1 : 25,000, 1883—gives special agricultural information, like the maps near Berlin (see p. 12).

Austro-Hungary.

Kaiserlich-Königliche Geologische Reichsanstalt (Vienna).

This Survey was established in 1849, with W. von Haidinger as director; he was succeeded in 1867 by F. Ritter von Hauer.[1] Dionys Stur has been vice-director since 1877.

The field work of the survey, which is mostly done on the scale of 1 : 25,000, is at present divided into four sections:—(1) under G. Stache, in Tirol; (2) under E. von Mojsisovics, in N. Styria; (3) under C. M. Paul, in the Galician Carpathians; (4) under E. Tietze, in the western and north-western parts. There is a large staff of assistant geologists and others.

There are in all about twenty-three official topographical maps of Austro-Hungary or of parts of it, on scales from 1 : 12,500 downwards. These are all being absorbed in the 'Neue Special-Karte,' scale 1 : 75,000, on which the geological information is published; the complete map

[1] Resigned early in 1885.

will be in 715 sheets, of which 270 are published with the geology, dating from 1870.

The meridian is Ferro, 18° 9' W. of Greenwich. The heights are given in metres; there are contour-lines at intervals of 50 metres. The sheets are not quite rectangular, the right and left edges being always meridian lines, 30' apart.[1]

The maps are denoted by a double system of numbering—Vertical (*Colonne*) (I to XXXV) and Horizontal (*Zone*), 1 to 37.

The 270 sheets now published are thus grouped:—

Upper and Lower Austria	38 sheets
Moravia and Silesia	30 „
Tyrol	37 „
Illyria, Styria, and Salzburg	45 „
Galicia and Bukowina	101 „
Hungary	12 „
Bohemia	7 „
	270 „

The prices vary from 1 to 8 fl. (2 to 16 sh.).

A smaller map, scale 1 : 144,000, is also published, of which 158 sheets are issued. This map is divided into various provinces. The sheets now published are as follows, the prices varying from 1 to 6 fl.:

Austria above and below the Ems	29 sheets
Salzburg	13 „
Styria and Illyria	36 „
Bohemia	38 „
Hungary	42 „
	158 „

The following general maps are issued:—

Hungary	18 sheets
Lombardy and Venetia	4 „
Transylvania	4 „
Banat	4 „
Slavonia and the Frontier	1 „
Bosnia and Herzegovina	7 „
Dalmatia	2 „

The publications of the survey, other than maps, are:—

'Abhandlungen der k. k. geol. Reich.', of which ten volumes have appeared, dating from 1852, price, 23 to 70 fl.; some of these contain maps on a large scale; 'Jahrbuch,' from 1850; 'Verhandlungen,' from 1867. A 'General-Register' of the 'Jahrbuch' is published.

Numerous memoirs, stratigraphical and palæontological, from the 'Abhandlungen' are separately issued.

Several semi-official memoirs, with large maps or special maps, are published by officers of the survey, the most important being:—

V. Mojsisovics, 'Dolomitriffe von Südtirol und Venetien,' 2 vols. 1879, price, 19 fl. Map, in 6 sheets (1 : 75,000), separately issued.

V. Mojsisovics, Tietze, and Bittner, 'Grundlinien der Geologie von Bosnien-Hercegovina, 1880, price, 12 fl. Map, 1 : 576,000.

V. Hauer, 'Geol. Uebersichtskarte der österr.-ungar. Monarchie,' 12 sheets, 1 : 576,000; 45 fl.

V. Hauer, smaller map of the same, 1 : 2,016,000, 4th ed. 1884; 6 fl.

[1] This most convenient arrangement is also adopted in the maps of Prussia and Saxony.

Bohemia.—This is a section of the Austrian Survey, under the control of Anton Fritsch; the maps are those of the 'Neue Special-Karte,' scale 1 : 75,000, referred to above. The text is included, as 'Geologische Abtheilung,' in 'Archiv der Naturw. Landesdurchforschung von Böhmen,' with plates and extra maps on various scales.

Hungary.—This Survey was established as a section of the Austrian Survey in 1868, but was soon after made a distinct body under the title 'Königliche ungarische geologische Anstalt;' its head-quarters and the place of publication is Budapest. But it is still in connection with the central institution at Vienna, and an abstract of its work appears in the Verhandlung.

The first director was Max von Hantken, who was succeeded in 1882 by Johann Böckh. The survey is done on the scale of 1 : 28,800.

The publications date from 1871. These are in Hungarian, but a German version is given in 'Mittheilungen, aus dem Jahrb. k. u. geol. Anstalt,' dating from 1872. About 22 sheets of the map are published.

Bavaria.

Bureau der Geognostischen Untersuchung des Königreichs Bayern (Munich).

The survey was commenced in 1851, under C. W. von Gümbel, the present director. The publications date from 1858; they have been issued at Gotha, but in future will be published at Cassel.

The field work is done on various scales, from 1 : 5,000 to 1 : 25,000; the publication is usually on the scale of 1 : 100,000, but in special cases 1 : 50,000.

Two meridians are used on the maps—Ferro (18° 9′ W. of Greenwich) and Munich (11° 36′ E. of Greenwich). The maps are not contoured.

Explanations of separate sheets are not published, but the maps are grouped, for purposes of explanation, as follows:—

1 'Geognostische Beschreibung des bayerischen Alpengebirges und seines Vorlandes' (southern frontier), 5 maps. 96 marks. 1861.

2. 'Geog. Besch. des ostbayerischen Grenzgebirges' (Bayreuth, Ratisbon, Passau), 5 maps. 108 marks. 1868.

3. 'Geog. Besch. des Fichtelgebirges und Frankenwaldes'. (N. of Bayreuth), 2 maps. 70 marks. 1879.

There is no official general map; but the director has published the following, without text:—'Geog. Uebersichts-Karte des Königreichs Bayern,' Munich, 1858, 1 : 500,000. Price 17·20 marks.

Belgium.

Service de la Carte Géologique de la Belgique (Brussels).

This survey is conducted as a part of the 'Musée Royal d'Histoire Naturelle de Belgique' (Brussels). The work is executed under the 'Commission de Contrôle de la Carte Géologique de la Belgique' com-

posed of five members of the Royal Academy of Belgium, with M. J. Stas as president. The surveying work is done under the direction of Ed. Dupont, with three 'conservateurs' and eleven assistants. A peculiar feature of this survey is that each main division of the geological series is traced out completely by one man, so that an index map of progress is also a geological index map.

The map is on the scale of 1 : 20,000, with contours at 5 metres nterval on the left bank of the Meuse, and at 10 metres on the right bank. The map is in 72 main divisions ('planchettes'); each containing, when complete, 8 sheets ('feuilles'); in all there will be 430 sheets. The meridian is Paris, 2° 20′ E. of Greenwich. Each sheet is accompanied by 'Texte explicatif.'

The maps give the nature of the soil, and note, by dark shades of colour, the actual areas at which solid rock is exposed. Six sheets are published, dated 1882 and 1883.

The memoirs issued by the Musée Royal (to which the Survey is now attached) are in two forms, dating from 1877:—

'Annales du Musée R. d'Hist. Nat. de Belgique,' in fol., each volume with atlas; and 'Bulletin,' in 8vo. The former is divided into four series —palæontology, lithology, stratigraphy, existing fauna.

Before the establishment of the existing Survey another had been in existence, conducted by a Committee of which M. Jochams was president. It was founded, in 1878, under the control of the 'Ministère de l'intérieur;' this is stated on each publication, which may thus be distinguished from the publications of the existing Survey, the latter being headed 'par ordre du Gouvernement.'

About 20 maps were published (1879–81), each with text; 18 were by O. v. Ertborn and P. Cogels. Both Surveys have used the same topographical map.

A general map—'Carte Géologique de la Belgique, exécutée par ordre du Gouvernement,' scale 1 : 160,000—was prepared by André Dumont from 1836 to 1854, and was published in 1854. A new issue of this was made in 1877, in two editions—soil and rock, price 40 francs each map. This map was accompanied by Memoirs. Those on the 'Terrains ardennais et rhénan' were published by Dumont in the *Mém. Acad. Roy. Belgique*, 1847 and 1848; those on the 'Terrains crétacés et tertiaires,' prepared by Dumont and edited by M. Mourlon, are published in four vols. 8vo. 1878–1882.

A reduction (not official) of Dumont's map, scale 1 : 380,000, showing the beds below the Hesbayen and Campinien, was published in 1877 by Lelorrain and E. Henry.

Finland.

Finlands Geologiska Undersökning (*Suomenmaan Geologillinen Tutkimus*) (Helsingfors).

This survey was commenced in 1865, under the Department of the Administration of Mines, on the scale of 1 : 200,000; the director being K. Ad. Moberg.

The publication commenced in 1879; five sheets, in the neighbourhood of Helsingfors, were issued up to 1882. There are descriptions ('Beskrifning') to the sheets. All the superficial deposits are shown.

The explanations on the maps are given in Finnish and Swedish; the 'Beskrifning' is in Swedish.

The meridian is Helsingfors, 25° 12′ E. of Greenwich.

France.

Service de la Carte Géologique détaillée de la France (Paris).

The origin of this survey may be traced to the Paris Exhibition of 1855, when, under the direction of Dufrénoy and Élie de Beaumont, twenty maps (scale 1 : 80,000), were coloured geologically in MS. and exhibited. These maps, with others, amounting in all to about sixty, all in the N. and N.W. of France, were again presented at the Paris Exhibition of 1867.

The recognition of the value of such maps, and the fact that similar surveys were in progress in neighbouring countries, led to the establishment of the existing geological survey in 1868, with Élie de Beaumont as director. On his death, in 1875, M. Jacquot became director.

The map employed is the 'Carte Topographique de l'État-Major,' scale 1 : 80,000. The meridian is Paris, 2° 20′ E. of Greenwich. The map of France is in 258 sheets; Corsica in sheets, 259–267. It has hill-shading without contours; heights in metres.

Each map is accompanied by an 'Explication' printed on one side only, to be attached to the map if desired; some sheets also by plates containing longitudinal and vertical sections and photographs.

A very elaborate system of signs has been employed on the maps, for distinguishing minute varieties of rocks, soils, ores, mineral springs, &c. The number of these signs is 1,113. In addition to these many subordinate signs have been devised, further explaining or modifying the others.[1]

As the work progresses it will be reduced and published on the scale of 1 : 320,000; this will be in 32 sheets; Corsica in sheet 33. Each sheet of this map will include 16 sheets of the larger scale.

The publication of the maps commenced in 1873, with sheet 48, Paris; the explanation of this being 'Cahier I.' About 67 sheets are issued (to February 1885), chiefly in the north.

In addition to the explanations of sheets there are 'Mémoires'; No. 1, 'Pays de Bray,' by De Lapparent, was published in 1873; No. 2, 'Minéralogie Micrographique,' by Fouqué and Levy, in 1879. There are also special monographs on the coalfields—Brioude and Brassac, Langeac, and the Loire.

The foregoing statements refer only to the existing survey, but there were official publications of earlier date.[2] In 1822, incited thereto

[1] All these signs, &c., are fully explained in pamphlets issued in 1874, 'Généralités' A, B, C, and D. See also De Chancourtois, *Ann. Mines*, ser. 7, t. v. 1878.

[2] A notice of the various geological maps of France was given, by Professor G. A. Lebour, in the *Geographical Magazine*, vol. iii.p. 47, 1876.

by the publication of Greenough's 'Geological Map of England and Wales' (1819–20), a survey was commenced by Dufrénoy and Élie de Beaumont, under the direction of Brochant de Villiers. From 1822 to 1825 the surveyors were studying field geology in England. In 1825 the work was commenced in France, De Beaumont taking the east, Dufrénoy the west. There were two assistants, and the survey was completed in 1830.

The map, 'Carte Géologique de la France,' is in 6 sheets, scale 1 : 500,000. It was published in 1840–42; the two volumes of 'Explication' in 1841 and 1848.

A reduction of this map ('Tableau d'Assemblage'), scale 1 : 2,000,000, was published in 1841.

There are a large number of maps and memoirs of Departments, of which great use is made by the surveyors. Some are by private geologists, but most are by official mining engineers. These maps are on various scales; some, as that of the Pas de Calais (by Du Sonich, 1851) on the full scale of 1 : 80,000.

A Geological Map of France in 48 sheets, scale 1 : 500,000, is in preparation by C. Vasseur and L. Carez.

Italy.

Reale Comitato Geologico d'Italia (Rome).[1]

This survey was commenced in 1868, when the capital was Florence. It was directed by a committee of Professors at Universities and Engineers of Mines. In 1873, when the chief office and place of publication were transferred to Rome, the staff was reorganised; the *Comitato* (with Professor Meneghini as president) retained mainly a consulting power, the real chief of the survey being F. Giordano, the present director. The staff consists of 7 geologists, 3 assistants, and a palæontologist.

The systematic and detailed investigation of the country dates from 1877, and was commenced in Sicily; in 1879 the survey was extended to the Apuan Alps and the Roman Campagna. The scale adopted for the survey is usually 1 : 50,000; areas of special interest, such as those mentioned above, are surveyed on the scale of 1 : 25,000. Recently some surveys have been made on the scale of 1 : 10,000—of Elba, Ischia, and the environs of Rome.

A general map (1 : 1,111,111) was published in 1881 : another, on the scale of 1 : 500,000, is now in preparation, Sicily being published (1883).

The systematic publication of the survey map will be on the scale of 1 : 100,000, in 277 sheets, those of Sicily being nearly ready for issue.[2]

Districts of special importance will be published on the scale of 1 : 25,000, with contours; Elba, in two sheets, is now ready.

In the topographical maps prepared by the Italian Government (of which there are 18, on various scales), the meridian is reckoned from Rome (Monte Mario), which is 12° 28′ E. of Greenwich. There is a topographical map, prepared by the Austrian Government, on the scale of 1 : 75,000, in which the meridian is reckoned from Ferro; but this map is not used by the Geological Survey.

[1] For a fuller account of this Survey, see *Nature*, Nov. 24, 1881.

[2] Four sheets, with a sheet of sections, were published at the end of 1884

The publications comprise the 'Bollettino,' (in 8vo.), dating from 1870, of which fourteen volumes are published; and 'Memorie' (in fol.), dating from 1871, of which two volumes are published. These volumes contain numerous maps, on various scales, and plates of fossils. Many of the authors of papers here published are not connected with the survey; but, as a Geological Society was founded for Italy in 1881, the survey publications will probably in future be more purely official.

Several semi-official maps are issued. Three are by Prof. Capellini, a member of the *Comitato*. These are—the Bolognese Apennines; Leghorn (each 1 : 100,000); Gulf of Spezia (1 : 50,000).

Netherlands.

Commissie voor de Geologische Kaart van Nederland (Haarlem).

An official survey of this country was made by W. C. H. Staring, and published ('Geologische Kaart van Nederland') at Haarlem, in 27 small sheets; 1858–67 with explanation. The scale is 1 : 200,000; the meridian Amsterdam, 4° 55′ E. of Greenwich. The map shows 13 varieties of alluvium, 8 of diluvium, 16 of Pliocene—Eocene, with other rocks down to Devonian.

Another map (? not official) has been published by Kruijder, in six sheets, 1880.

Norway.

Geologiske Undersögelse (Christiania).

The geological investigation of this country is in two parts. That of Southern Norway, under the direction of Th. Kjerulf, dates from 1858; that of Northern Norway, under the direction of T. Dahll, dates from 1866, and was completed in 1878. For the former there are two assistants, with extra help during the summer.

The surveying work is done on various scales—for the most part 1 : 100,000, but some 20/, 50/, and 200,000. For the last the meridian is Ferro; for the others it is Christiania, 10° 43′ E. of Greenwich.

The published map of Southern Norway, in rectangular sheets, is on the scale 1 : 100,000, with contours at 100 feet (1 Norwegian foot = 12.35 English inches). Seventeen sheets are published, dating from 1876. These are grouped as follows: Trondhjem and district, 8 sheets; Bergen, 2; Hamar, 2; Christiania and Fredrickstadt, 5. Each sheet is priced kr. 1·60 (1 kr. = 1*s.* 1¼*d.*).

A general map of part of Southern Norway (Diocese of Christiania, Hamar, and Christiansand) was published in 1856–65, by Th. Kjerulf and T. Dahll; scale 1 : 400,000; 10 sheets; with explanatory pamphlet in French; in this the meridian is Ferro.

A general description of Southern Norway with atlas and map ('Geologiske Oversigtskarte,' 1 : 1,000,000), was published by Th. Kjerulf in 1879. (German translation, by Dr. A. Gurlt, in 1880). A

map of Northern Norway ('Geologisk Kart over det Nordlige Norge') on the same scale, was published in 1879 by T. Dahll.

There is no regular publication of memoirs and papers of the survey; but they appear in 'Nyt magazin for naturvidenskab,' and in other journals, transactions, and University treatises. The collection made by the survey is at present deposited in the Mineralogical Cabinet of the University of Christiania.

PORTUGAL.[1]

Secção dos Trabalhos Geologicos de Portugal (Lisbon).

This survey was commenced in 1857 (as Commissão Geol. de Portugal). It was reorganised with the existing title in 1869, under the direction of Carlos Ribeiro; he was succeeded, in 1883, by J. F. N. Delgado.

The work is now done on the scale of 1 : 100,000; with occasional enlargements to double this scale. There are contours at intervals of 25 metres. The map will be in 37 sheets, longitude reckoned from Lisbon, 9° 9′ W. of Greenwich. The topographical map is not yet complete, and none of the sheets are published with the geology.

Several memoirs have been published, dating from 1865; and also a general map—'Carta Geologica de Portugal,' by C. Ribeiro and J. F. N. Delgado, scale 1 : 500,000; 1876 (now out of print).

PRUSSIA.

Königliche Geologische Landes-Anstalt und Bergakademie zu Berlin (Berlin).

The publications of this survey date from 1870; the director is W. Hauchecorne.

The map—'Geologische Special-Karte von Preussen und den Thüringischen Staaten' is on the scale of 1 : 25,000; with hill-shading, and contours at intervals of 5 metres.

It is divided into 88 'Grad-Abtheilungen;' each subdivided into 60 'Blättern,' excepting on the frontier and sea-board, where some sheets are absent. Each complete 'Grad-Abtheilung' contains exactly 1° of long. and 1° of lat.; each 'Blatt' contains 10′ of long. and 6′ of lat.; the sheets are therefore not quite rectangular. The longitude is reckoned from Ferro, 18° 9′ W. of Greenwich.

The publication takes place in 'Lieferungen,' each containing from three to nine maps of the same district, though not always in the same 'Grad-Abtheilung.' The 'Lieferungen' vary in price according to the number of maps included, averaging 2 marks per map with its 'Erläuterung.' The maps near Berlin are especially agricultural, minute variations of soil being indicated by signs; these form a special set of maps, in 27 sheets. In the coal districts two editions are issued, one showing the edges of the coal-seams beneath the newer rocks.

[1] The first part of the serial publication of this Survey has just been issued—'*Communicações da Secção dos Trabalhos Geologicos de Portugal*,' tom. 1, fasc. 1, 1885; 8vo. Lisbon. Some of the papers therein contained had been previously printed.

About 26 'Lieferungen' are issued, containing 142 sheets; which, for convenience of reference, may be grouped as follows:—

Berlin, Potsdam, &c.	27
Wettin, Jena, &c.	84
Wiesbaden, Frankfort, &c.	13
Saarbruck, &c.	18
	142

Although all maps fit into the complete system of 'Grad-Abth.' and 'Blatt.' the earlier sheets published have a different set of numbers. The position of each map however, and its relation to the new system of numbering, can be seen from the index-map on each 'Lieferungen.'

A descriptive text ('Erläuterung') is issued with each map.

There are also 'Abhandlungen,' dealing with special districts, palæontology, &c. These date from 1872. They contain numerous plates and maps, the latter being sometimes separately issued.

The 'Jahrbuch,' dating from 1880, contains shorter papers, reports &c.

A reduction of the above-mentioned map—'Geologische Karte der Provinz Preussen,' scale 1 : 100,000, is in course of publication.

Numerous general maps of Germany or of parts of it are published, the most important of which is that of H. von Dechen—'Geologische Karte der Rheinprovinz und der Provinz Westfalen,' in 35 sheets, scale 1 : 80,000. A continuation of this map, on the same scale, being a reduction of the new Prussian survey, is now being prepared. The Wiesbaden sheet (numbered 35) was issued in 1882.

Geological surveys of some German States have been made on the scale of 1 : 50,000, not all directly by the Government; but the great survey above described will probably absorb these, and will re-map the districts on the larger scale.

Amongst these local surveys are the following:—

Baden, made by Zittel and Sandberger.

Hesse. 'Geologische Specialkarte des Grossherzogthums Hessen und der angrenzenden Landesgebiete.' This survey, under the direction of R. Ludwig, is in eighteen sheets, with text. It was made by the 'Mittelrheinischer Geologischer Verein' (Darmstadt), and was published from 1856 to 1872.

Upper Silesia.—A 'Specialkarte der Oberschlesischen Bergrevier.' scale 1 : 10,000, is published by the 'k. Oberbergamt in Breslau'; in 'Lieferungen,' of ten or more sheets. The price of each sheet is 1½ mark.

Roumania.

Biurouluĭ Geologicŭ Românŭ (Buchurest).

Established in 1882, under the direction of Gregoriŭ Stefăneseu, for the purpose of providing materials for the International Geological Map of Europe. One Report has been published ('Anuarulŭ Biurouluĭ Geologicŭ,' anulŭ 1882–1883, No. 1, pp. 114, 1884). The rocks contained within the kingdom, which are briefly described in this Report, are:—Crystalline Schists (Archæan), Jurassic, Eocene, Miocene, Pliocene and Quaternary. This Report contains descriptions, with analyses, of mineral springs.

Russia.

This survey[1] was commenced in 1882; the director is B. Theresheff.

The publications comprise Reports in 8vo., and Memoirs in 4to; the latter are illustrated by maps and plates; some of the Memoirs are descriptive of sheets of the maps, others of certain formations in various districts.

The Reports are in Russian only; the Memoirs have title in French ('Mémoires du Comité géologique'), and a translation or prècis in German.

The map is on the scale of 1 : 420,000; to be completed in 154 sheets; 3 sheets are published. The meridian is Pulkowa, 30° 19′ E. of Greenwich.

The map has explanations and title in French:—'Carte géologique générale de la Russie d'Europe.'

A map of the Urals, prepared by the mining engineers, has been published by A. Karpinsky—'Geologische Karte des Ostabhanges des Urals,' 3 sheets, 1884. Scale 1 : 420,000; with enlarged parts of 1 : 210,000.

Saxony.

Königliche Geologische Landesuntersuchung von Sachsen (Leipzig).

This survey dates from 1872; the publications from 1877.[2] The director has from the commencement been Hermann Credner. There are eight assistant geologists.

The scale for mapping and publication is 1 : 25,000; the meridian is Ferro, 18° 9′ W. of Greenwich. The maps—'Geologische Special-Karte des Königreiches Sachsen,' are contoured at intervals of 5 metres on the lowlands and 10 metres on the hills.

The division of the maps, as regards lines of latitude and longitude, is the same as in the Prussian maps. The maps of Saxony have a special numbering of their own, but most of those now published would be contained within Grad-Abth. 58 and 72 of the large Prussian map.

The maps show all the drift-deposits, the soils being sometimes noted and described in detail. In some cases a separate edition, showing only the solid rock, is issued. There are also special issues for certain mining districts.

Much attention is paid to the petrological variations in the crystalline rocks, these being noted by letters and signs.

Thirty-five sheets are published, all in the western part of Saxony, but those in the extreme south-west are not yet issued. The price of each sheet is 2 marks; of the accompanying 'Erläuterung' 1 mark.

A general map has been published by the director, 'Uebersichtskarte des Sächsischen Granulitgebirges und seiner Umgebung,' scale 1 : 100,000, 1884; price, with Erläuterung, 5 marks.

[1] For descriptions of this Survey, and of its publications, see *Nature*, vol. xxix. p. 93; xxx. p. 608; *Geol. Mag.*, dec. iii. vol. i., p. 84, 1884.

[2] Detailed descriptions of the work and publications of the Survey of Saxony have been published by the director (H. Credner) in *Mittheil. des Vereins für Erdkunde zu Leipzig*, 1877 and 1880.

Spain.

Comision del Mapa Geológico de España (Madrid).

The Commission was formed in 1849, with F. Luxan as director. At one time under the Statistical Department, it was, in 1870, placed with that of the Mining Engineers. The existing organisation and systematic publication date from 1873, when the present director, Manuel Fernandez de Castro, was appointed.[1]

The Government topographical map of Spain is on the scale of 1 : 50,000, with contours at 20 metres apart. This was commenced only in 1875, and few sheets are published; it will be completed in about 1,080 sheets; this map is not used by the Geological Survey. Maps published by F. Coello on the scale of 1 : 200,000, are those usually employed in the field work of the survey. The longitude in all is reckoned from Madrid, 3° 41′ W. of Greenwich.

The staff of the survey since 1873 has usually contained six mining engineers and seven or eight assistants.

The maps are issued on the scale of 1 : 400,000, with the reports on each province (see below).

The publications of the survey consist of the 'Boletin,' dating from 1874, and the 'Memorias,' dating from 1873.

Each volume of the 'Memorias' is devoted to the 'Descripción física y geológica' of a single province; mining is added in the title of some, and agriculture in others; these latter being those written by Daniel de Cortázar. The volumes, of from 200 to 400 pages, contain plates of fossils, sections, &c., and also the maps (1 : 400,000) already referred to.

The 'Boletin' contains shorter descriptions of special districts, translations of foreign memoirs on Spanish geology, &c. The maps here are on various scales. Altogether, since 1873, twenty-seven provinces have been described; eleven of them with maps of 1 : 400,000.

Descriptions of some provinces, with maps, were published before the reorganisation of the survey in 1873; some had maps of 1 : 400,000.

The palæontological work of the survey is scattered throughout the various volumes, but this is now being collected and separately issued.

The largest (and in some respects the best) general map of Spain and Portugal is that of De Verneuil and Collomb (1 : 1,500,000), published in Paris in 1864; and a 2nd edition, with text, in 1868 (now out of print). Another map (1 : 2,000,000) was published by F. de Botella, of the Spanish Survey, in 1881. The price of this is 15 francs; there is no text.

At the conclusion of the work of the survey, now approaching, a complete map of Spain, on the scale of 1 : 400,000, will be published, in sixteen sheets; the first sheet will probably be published in 1885.

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[1] A full account of this survey was published for the Mining Exhibition in Madrid, 1883—*Com. Mapa Geol. Españ., su origen, vicisitudes y circunstancias actuales*, with two index maps (*Boletin*, t. x.). An earlier publication—'*Memoria . . . . del Mapa Geol. España.*' 1876, Madrid, pp. 183, gives a full account of the geological literature of Spain (in provinces) and its foreign possessions.

Sweden.

Sveriges Geologiska Undersökning (Stockholm).[1]

This survey was commenced in 1858 with Alex. Erdmann as director. In 1869–70 the director was A. E. Törnebohm; he was succeeded in 1871 by the present director, Otto Torell.

The staff consists of twelve geologists, with some additional assistants during the summer months.

The survey is made on two scales; in the more populous districts, 1 : 50,000; in the mountainous districts, 1 : 100,000. In the former case the maps are published on that scale, in the latter the publication is on the scale of 1 : 200,000.

The meridian is Stockholm, 18° 3′ E. of Greenwich. The maps are not contoured, but numerous heights are given in Swedish and Norwegian feet (=12·35 English inches).

The publications date from 1862.

Of the sheets on the 1 : 50,000 scale (Ser. A, a) about 83 are published; these are numbered in the order of publication, irrespective of their relative positions. Each sheet is accompanied by a descriptive 'Beskrifningar.' The prices, for map and description, are 2 kronor) for the full sheets, 1 or 1½ kroner for the coast sheets (1 kroner =1*s.* 1¼*d*).

Of the sheets on the scale of 1 : 200,000 (Ser. A, b) ten are published; each with 'Beskrifningar,' price 1½ kroner.

All the maps give the distribution of the superficial deposits, but a few are published with special reference to these and to agriculture. That of the environs of Skottorp, scale 1 : 4,000, shows by signs the nature and composition of the soil in great detail. There are also some special maps referring to mining, &c.; these extra maps are in Ser. B.

A general map of Southern Sweden (south of lat. 59° 45′), on the scale of 1 : 1,000,000, will probably be published with a description during this year (1884).

In addition to the explanations of the maps there are memoirs in Ser. C ('Afhandlingar och uppsatsen') in 8vo. or 4to., with or without plates or atlas. Eighty of these are published, dating from 1863, at various prices up to 8 kroner. They refer to palæontology, stratigraphy, petrology, economic and theoretical geology; most are in Swedish, but a few are in French, German, or English.

A map of the iron district of Central Sweden, though not an official publication of the survey, should be mentioned here. This was prepared, by A. E. Törnebohm, for the Board of Swedish Ironmasters (Jernkontoret). It is in nine sheets (1879–82); each, with description, price 4 kroner. Its title is 'Geologisk Ofversigtskarta öfver Mellersta Sveriges Bergslag;' the scale is 1 : 250,000.

Another similar publication, also by Törnebohm, is 'Geologisk atlas öfver Dannemora Grufvor,' in 17 sheets, with description, 1878.

All the publications referred to are issued at Stockholm.

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[1] This survey is described in *La Carte géologique de la Suède et ses envois à l'Exposition Universelle de Paris en* 1878, *avec une description succincte des formations géologiques de la Suède.* 8vo. Stockholm, pp. 57, 1878.

Switzerland.

Beiträge zur Geologischen Karte der Schweiz (*Matériaux pour la Carte Géologique de la Suisse*) (Berne).

The present organisation dates from 1859, when the Federal Council offered to the Swiss Natural History Society a grant in aid of colouring geologically the topographical map ('Carte Dufour'). A geological commission of five members was then formed, with Bernhard Studer as president.

The map is in 25 sheets; three of the corner sheets are for title, index, &c. Eighteen sheets are published, those not yet issued being XIII., XIV., and XVIII., all in Central Switzerland.

The scale is 1 : 100,000; the meridian is Paris, 2° 20′ E. of Greenwich.

The text, chiefly in German, but partly in French and Italian according to the locality described, is contained in 'Lieferungen' 1–28, dating from 1862. Some of these describe one or more sheets of the map; others describe special districts, with maps on the scale of 1 : 50,000 or 1 : 25,000.

A general map, 'Carte Géol. de la Suisse,' was published by B. Studer and A. Escher von der Linth in 1853, scale 1 : 350,000; with text—'Geologie der Schweiz,' by B. Studer, 2 vols., 1851–53.

United Kingdom.

Geological Survey of the United Kingdom (London).

The founder of this survey was H. T. De la Beche, who before 1832 had coloured geologically the Ordnance one-inch maps of the South-West of England. In that year a small grant was made by the Government towards the cost of publishing these maps by the Ordnance Survey, but De la Beche also contributed money for the purpose. Subsequently De la Beche was definitely appointed to make a Geological Survey, under the direction of General Colby, then the head of the Ordnance Survey. The first result of this was the publication of the 'Report on the Geology of Devon, Cornwall, and West Somerset,' 1839, with the one-inch maps of the district.

About 1832 other geologists were surveying various districts upon the one-inch maps of the Ordnance Survey—William Smith in many parts,[1] and W. Lonsdale near Bath. H. Maclauchlan and J. R. Wright (both of the Ordnance Survey) mapped the Forest of Dean and the country around Ludlow respectively, W. Logan surveyed part of S. Wales; the information collected by these three observers was incorporated in the official geological maps.

In 1845 the Geological Survey was detached from the Ordnance Survey and was placed under the 'Office of Woods and Works;' in 1854 it became a branch of the 'Department of Science and Art.'

From about the year 1832 some officers of the Ordnance Survey in the N. of Ireland collected geological information, which was completed and published by Captain J. E. Portlock in 1843.

[1] Smith made a Geological map of Somersetshire upon the one-inch scale in 1799.

The geological survey of Ireland was commenced in 1845, with Captain H. James as director, the subsequent directors being T. Oldham, 1845; J. B. Jukes, 1850; E. Hull, 1869.

The survey of Scotland was commenced in 1854, and was made a distinct branch of the geological survey in 1867, with Arch. Geikie as director, succeeded in 1882 by H. H. Howell.

England, the original home of the Survey, was presided over by De la Beche as director till 1845, when A. C. Ramsay became director; he was succeeded in 1872 by H. W. Bristow, now the senior director.

The dates of appointment of the Directors-General are: H. T. De la Beche, 1845; Sir R. I. Murchison, 1855; A. C. Ramsay, 1872; Arch. Geikie, 1881.

Until 1845 the Survey was known as that of *Great Britain*; when the survey of *Ireland* was commenced, the original name was confined to that of Great Britain proper, the entire Survey being called that of the *United Kingdom*. In 1867 the title of Great Britain was discontinued entirely, this Survey being divided into those of *England and Wales* and *Scotland*.

The total number of the staff of the Geological Survey is now fifty-seven, distributed as follows: one Director-General, three Directors, three District Surveyors, fourteen Geologists, twenty-five Assistant Geologists, four Naturalists and Palæontologists, four Fossil Collectors, three General Assistants.

The survey of the greater part of England has been done on the 1-inch Ordnance maps (1 : 63,360). In the North of England the 6-inch maps (1 : 10,560) have been used, and much of the ground has been published on this scale. In the South of Scotland the 6-inch maps have been used; but in the North of Scotland the survey will be mainly on the 1-inch scale. In Ireland the 6-inch maps have always been employed for field work.

The contours on the 6-inch maps are usually at intervals of 100 feet up to 1,000 feet, above that at intervals of 250 feet. In the maps of Yorkshire the contours are more numerous. The old 1-inch maps, on which alone the geology is yet published, have no contours, but heights are marked in some districts.

In Ireland the drift has always been shown upon the 1-inch maps by 'stippling.' Originally no glacial drift was shown upon the English maps; but in 1871 the publication of *drift maps* was commenced, and two editions of many of the maps are now issued—*solid* and *drift*. In the East of England only the drift maps are issued, very little being here known of the solid geology.

At the end of 1883 the field survey of the original 1-inch map of England and Wales was completed; the survey of the drifts of the areas over which these are not yet mapped has been commenced.

In Ireland and Scotland there is only one system of numbering the maps. In England some maps are in *sheets*, some are divided into *quarter-sheets*. In the new maps of the Ordnance Survey the system of dividing into quarter-sheets will be discontinued. The maps and their divisions in the North of England are the same in the old and the new series, the numbering only being different; but in the South of England there is no relation between the boundaries of the old and the new maps.

In addition to the maps there are 'Horizontal Sections,' on the scale (for heights and distances) of six inches to a mile. These are published at 5*s*. each; many have 'Explanations,' price 2*d*. each.

The details of Coal Measures, Cliff Sections, &c., are given on sheets of 'Vertical Sections,' 3*s*. 6*d*. each.

An 'Index Map,' scale four miles to the inch (1 : 253,440) has been published of Wales and the adjacent districts, in six sheets, price 3*s*. 6*d*. each. An Index Map of the whole of England and Wales, upon the same scale, is now in progress.

In all maps of the United Kingdom the meridian is Greenwich.

The publication of the Maps of England dates from about 1839, those of Ireland from 1855, of Scotland from 1859.

The number of maps and sections published is shown in the following table[1]:—

—		England and Wales	Ireland	Scotland	Total
1-inch map (1 : 63,360) (sheets or quarter-sheets in England and Wales)	Solid . . . . 183 Drift edition of solid map 49 Drift only . . 12	244	180	33	457
6-inch maps (1 : 10,560)		216	10	128	354
Horizontal sections		129	30	9	168
Vertical sections		69	1	7	77
Total		658	221	177	1,056

The prices of the 1-inch maps are from 1*s*. 6*d*. to 8*s*. 6*d*. for England (a few detailed drift maps at higher prices); 1*s*. 6*d*. to 3*s*. for Ireland; 4*s*. to 6*s*. for Scotland; of the 6-inch maps, 4*s*. to 6*s*.

The 'Memoirs' of the Geological Survey date from 1845. Four volumes were consecutively numbered; vol. 1 and vol. 2 (in two parts) contain several papers. The other two volumes and all later 'Memoirs' are each confined to one subject or district.

Memoirs or Explanations of sheets of the map have been issued since 1859; those published are—for England, 49; Ireland, 92; Scotland, 17.

British fossils are described in 'Decades' (thirteen published, from 1849) and 'Monographs' (four published, from 1859).

'Mineral Statistics' were published annually from 1853 to 1882; but in 1883 the Mining Record Office, in which these were prepared, was removed to the Home Office, and the statistics are now issued as parts of the Reports of the Inspectors of Mines.

No official general map has been issued by the survey, but the following maps, on scales varying from seven to eleven and a half miles to the inch, have been published by the directors of the respective surveys; they are reductions of survey work to date: British Islands, by A. C. Ramsay, 1878; England and Wales, by A. C. Ramsay, 4th ed. 1879; Ireland, by J. B. Jukes, 1867; Ireland, by E. Hull, 1878; Scotland, by A. Geikie, 1876.

[1] A *Catalogue of the Publications of the Geological Survey of the United Kingdom* to 1884 has been issued, with index maps, pp. 95, price 1*s*.

APPENDIX.

GEOLOGICAL MAP OF EUROPE.

ALTHOUGH only a small area of Europe has yet been published by the Surveys described above, enough is now known of its geological structure to justify the preparation of a complete map, on a scale sufficiently large to allow all the main subdivisions to be shown. This task has been undertaken by the International Geological Congress, which, during its meeting at Bologna in 1881, appointed a Committee to carry out the work. The Committee is formed as follows:—

In Germany . . .	E. Beyrich, W. Hauchecorne	Directors of the Map
„ Austro-Hungary . .	E. Mojsisovics	
„ France	A. Daubrée	
„ Great Britain . .	W. Topley	
„ Italy	F. Giordano	
„ Russia	A. Karpinsky	
	E. Renevier, Secretary.	

The Map will be in 49 sheets (7 by 7), measuring in all about 12 feet by 10 feet. The scale is 1 : 1,500,000 (about 23¾ miles to one inch). The expense of producing this Map is far beyond the means of the Congress; it was therefore resolved to apply for assistance to the various Governments of Europe. In most cases the money required was immediately promised, and in others satisfactory arrangements for the amount required have been made. England's share of the expense is 400*l.*, yearly instalments of which have been given, as required, by the Royal Society from its Government Grant. For this sum 100 copies of the Map will be returned.

The Map is being prepared at Berlin, and will be published there by Reimer & Co. A new topographical map is being prepared by Prof. Kiepert. Streams and railways are given in detail; in selecting the names of places special care is taken to mark those of geological interest or importance; the names of mountain chains and chief hill-ranges are given, the heights of the summits being marked in metres. The meridian is Paris, 2° 20′ E. of Greenwich. The topography is far advanced, and much progress has been made with the geology.

The subdivisions represented on the Map will probably be nearly as follows:—Alluvium and Quaternary, Pliocene, Miocene, Oligocene, Eocene, Cretaceous (3 divisions), Oolite (2), Lias, Trias (3), Permian (2), Carboniferous (3), Devonian (3), Silurian (2), Cambrian, Crystalline Schists, &c. (perhaps 2), Granite, Eruptive rocks (perhaps 6 or 7).

The geological information, as supplied by the various members of the Committee, is inserted under the supervision of W. Hauchecorne, the Director of the Geological Survey of Prussia; whatever success may attend the work will be mainly due to his energy and care.

LONDON: PRINTED BY
SPOTTISWOODE AND CO., NEW-STREET SQUARE
AND PARLIAMENT STREET

Syracuse, N. Y.
PAT. JAN. 21, 1908
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